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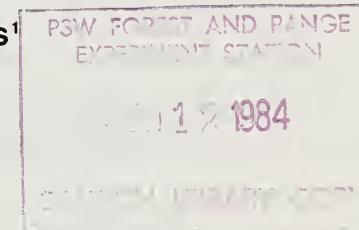
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## The Shoelace Tie-Down For Flight Line Markers

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Flight line markers for aerial photography can be constructed easily using polyethylene butcher paper secured to the ground with nails and light weight string or fishing line in a shoelace design.

**Keywords:** Flight line markers, aerial photography, photo interpretation

### Introduction

Ground flight line markers are an essential part of special purpose, low altitude aerial photo missions to assure aircraft orientation, site location, site delineation, and subsequent scale determination. To be most usable, the markers should be: (1) light weight and portable for easy transportation including backpacking to remote areas, (2) reusable, (3) durable, (4) easily installed, (5) adaptable to a variety of shapes and sizes, (6) inexpensive, and (7) highly visible.

Methods for marking sites on the ground for aerial photography have been detailed previously (Poulton 1975). One specific method utilized painted planks and rock (Heintz et al. 1979). This method meets criteria (2),

(3), (6), and (7), but fails the remaining criteria; especially (1). Another reported method utilizes polyethylene butcher paper and rocks, tree limbs, or other objects to hold the paper flat and to keep it positioned (Francis 1970); this method meets all the above criteria except (4).

The method described in this article is a shoelace tie-down for polyethylene flight line markers which meet all of the above criteria and keeps all portions of the markers secure and lying flat.

### Design and Installation

To properly install the shoelace flight line marking system, cut polyethylene butcher paper into the desired lengths and/or shapes to accommodate your specific needs. Paper which is 46 cm wide is easily obtained, and when cut into 3-m lengths before going to the field, it is easily handled. Remove vegetation, such as large shrubs or small trees, only if it interferes with marker place-

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ment. Lay out the polyethylene butcher paper shiny side up on the cleared area; for visibility, a natural opening is desirable in treelands. Insert two nails into the ground opposite each other at the sides of the paper, about 5 cm from the ends. Continue inserting nails at 8- to 46-cm intervals alternately from side to side along the strip of paper all the way to the other end (fig. 1). Allow approximately 2.5 cm of each nail to protrude above the soil surface.

Tie a length of string to a nail nearest the end of the paper. Stretch the string tight to the opposite nail, looping it twice, and then around every other nail that has been inserted into the soil surface. Alternate the string from side to side over the paper toward the opposite end, similar to lacing a shoe. Tie the string to the last nail at the end of butcher paper.

After the string has been installed at all nails, push the nail heads down to the soil surface. This will pull the sides of the butcher paper closer to the ground. The closer to the ground the butcher paper is installed, the less chance there is for wind to enter under the marker and possibly alter or destroy it. The farther the nails are inserted into the soil, the better they hold or grip the soil. Long nails are recommended for loose textured soils.

### Discussion

Polyethylene butcher paper is recommended and used because it withstands rain or snow. It has remained intact in the field for 15 months through varying kinds of weather. The paper comes in a roll which is easy to carry in a backpack and allows it to be cut at any desired length or shape if not cut prior to going to the field. Reuse of a marker is possible by either folding or rolling the paper.

String or non-monofilament fishing line is strong, lightweight, does not easily cut the edges of the butcher

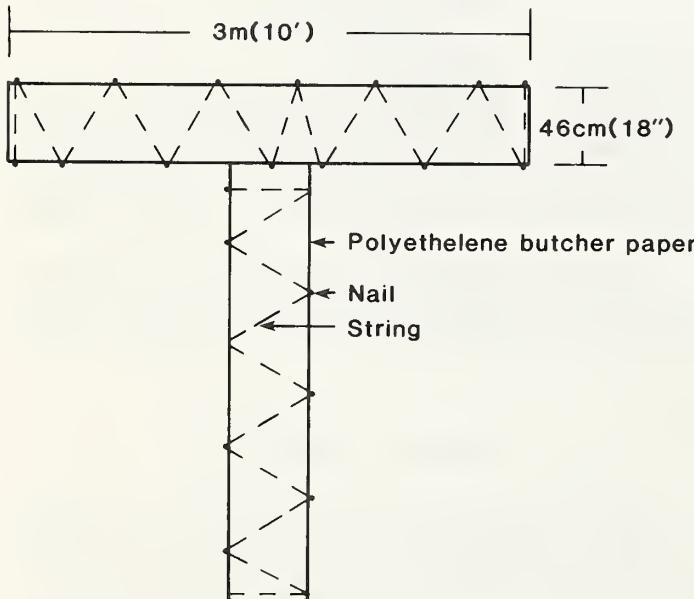


Figure 1.—Shoelace flight line marker diagram showing marker, string and nail positions.



Figure 2.—Photo of shoelace flight line marker showing marker, string, and nails.

paper, and is reusable. Nails which have large heads (number 16d or 20d) and are long have worked the best under various degrees of soil compactness, texture, and vegetation. However, shorter nails, such as 3-cm roofing nails, have been used successfully when the soil surface was difficult to penetrate.

A tape measure is useful to determine exact marker size and the exact distance a marker is placed from the end of a ground transect or the end of a flight line. Also, the distance between markers should be measured to determine photo scales. Vegetation should not be destroyed unless absolutely necessary, and markers should be removed immediately after use to avoid vegetation destruction. The markers may remain in place if the area is to be rephotographed within 2 weeks, or if the area is remote (fig. 2).

The polyethylene butcher paper and shoelace tie down is inexpensive, highly portable, visible at photo-scales of 1:24,000 or larger, and has been used in grasslands, shrublands, and open canopy treelands with excellent results.

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